

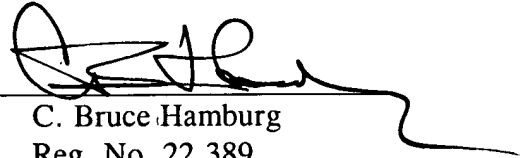
REMARKS

A substitute set of claims more suitable for U.S. practice has been provided, headings required in U.S. practice have been inserted and reference numbers have been deleted from the Abstract lest the Abstract be misconstrued as limiting the invention to the illustrated embodiments.

Respectfully submitted,

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METHOD AND CONTROL ARRANGEMENT FOR
TERMINATING ACCIDENTAL SWITCH ON OF A DEEP FRYER
APPARATUS NOT FILLED WITH OIL

Background of the Invention

5 The present invention relates to a method and control arrangement for
terminating an accidental switch on of a deep fryer apparatus when it is not filled
with oil, the deep fryer apparatus comprises a vessel closed at the bottom and at
the sides, and a substantially horizontally formed electric heating element being in
direct contact with the oil is placed within the vessel. Deep fat fryer apparatuses in
10 which the temperature of the oil can be raised to a required level by means of an
electrically operated heating element are often used in food industry. In the
method according to the invention the temperature is measured at one or more
determined points of the inner space of the vessel of the deep fryer apparatus, and
by observing the measured temperature value accidental switch on of the
15 apparatus with a vessel without oil is detected and terminated at the same time.

In the field of gastronomy there are known methods in which the
temperature is continuously observed, and based on the measured values certain
interventions in the operation are done. Patent application HU 9700221 discloses
a control unit for electronic control of gas-cookers and/or electric boiling plates

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and/or roasters, grillers and the like. The control unit has an EEPROM in which time and/or temperature dependent characteristic curves and/or cycle times are stored and also, it is adapted to store additional control settings modified relative to the ones stored in the EEPROM. Patent application DE 19628274 discloses a safety device in which accidental switch on of household cooking appliances or fryers is prevented by means of a decoder and an automatic voltage cut-off unit. The safety device is also applicable to switch off the cooking appliance or fryer when it is left switched on by chance. In both cases, detection of temperature takes place directly, therefore a prompt signal for performing an automatic counter-measure can not be provided for example when accidental switch on happens in a state entirely different from the proper use, for instance when there is no oil filled in the deep fryer.

With known apparatuses when they are switched on by accident without having oil filled in them, the temperature of the heating element and the neighbouring parts within the apparatus increases rapidly which usually leads to irreversible damage of the apparatus before accidental switch on is detected. To avoid this a temperature sensor is placed at one or more points within the apparatus. The signals of the sensor (s) are continuously observed and the filament current is cut off when the temperature exceeds a predetermined value. However,

experience shows that only a threshold of such a value can be determined with which the damage of the apparatus is unavoidable.

The object of the present invention is to provide an apparatus and method with which the filament current can be cut off at an earlier point of time, that is, before the apparatus without oil filled in it would inevitably be damaged when it is switched on accidentally.

Summary of the Invention

In the method according to the invention the derivative of the temperature measured at one or more given point(s) is defined, and the heating power is automatically cut off in order to terminate a switched on state of a deep fryer apparatus when the value of the derivative exceeds a predetermined threshold value.

The control arrangement according to the invention is adapted to determine the derivative of the temperature measured at one or more given point(s), and to cut off the heating power in order to automatically terminate a switched on state of a deep fryer apparatus when the value of the derivative exceeds a predetermined threshold value.

Brief Description of the Drawings

A detailed description of the invention will now be given with reference to the accompanying drawings in which:

Figure 1 is a diagram showing the temperature change plotted against time when the deep fryer apparatus is filled with oil ;

Figure 2 is a diagram showing the temperature change plotted against time when the deep fryer apparatus is not filled with oil ; and

Figure 3 is a diagram showing the temperature change plotted against time when the deep fryer apparatus is not filled with oil, and the heating power is cut off according to the method of the invention.

Detailed Description of the Invention

In Figure 1 a diagram showing the temperature change plotted against time can be seen in the case when the deep fryer apparatus is filled with oil. In the same diagram the change occurring in the power of the deep fryer apparatus (at the time of switching on and switching off) is also represented, resulting in a stepped function curve having two explicit values. It is perceptible that temperature 1 at the bottom part increases at a constant velocity, while temperature 2 in the vicinity of the surface changes almost likewise. When temperature 1 at the bottom part or temperature 2 in the vicinity of the surface reaches a predetermined

threshold value heating power is cut off automatically.

In Figure 2 a diagram showing the temperature change plotted against time can be seen in the case when the deep fryer apparatus is not filled with oil. Here, temperature 1 at the bottom part changes at a much higher velocity than
 5 temperature 2 in the vicinity of the surface. Then one of the two aforementioned temperatures may be compared to a predetermined threshold value and in case it exceeds the predetermined value heating power 4 is cut off. It is to be noted that a derivative of the temperature rise in case of Figure 1 or Figure 2 can be easily obtained on the basis of processing the measured temperature values. These
 10 derivative values 3 are marked in Figures 1 and 2. It is distinctly visible that the derivative value rises to a greater extent than the temperature itself when there is no oil filled in the apparatus. Consequently, according to the invention instead of observing the temperature the derivative value 3 of the same is observed and when this derivative value 3 reaches a predetermined threshold value heating power 4 is
 15 cut off. According to the foregoing the aforementioned temperature may be either temperature 1 at the bottom part or temperature 2 in the vicinity of the surface.

In Figure 3 a diagram showing the temperature change plotted against time can be seen when the deep fryer apparatus is not filled with oil, and the heating power is cut off according to the method of the invention. It is perceptible that the
 20 value of the derivative 3 presented by an abrupt curve provides a more appropriate

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reference point for observing the threshold value and to cut off the heating power
4 than direct observation of the temperatures, irrespective of the positioning of the
temperature sensors within the frying pan. In this way a much shorter reaction
time can be achieved, consequently the fryer apparatus would be damaged to a
5 lesser degree.

It can be seen in the figure that local oscillations occur in the value of the
derivative due to the nature of measuring and calculation, therefore it is practical
to average the momentary value in a preceding time-interval window having a
predetermined length, and the switched on state of the deep fryer apparatus is
10 terminated automatically when the averaged value exceeds the threshold value.

In an alternative embodiment a plurality of different threshold values may
be determined in accordance with temperature sensors positioned at a plurality of
determined points within the vessel of the deep fryer apparatus, and the switched
on state of the apparatus may be terminated automatically when the value of the
15 derivative of the temperature measured at any of the respective points exceeds the
relevant threshold value.

The present invention can be suitably used with all kinds of frying
apparatuses such as potato fryers in which the frying process takes place directly
in the oil, and temperature sensors are used for control of the frying process in any
20 case. The application of the method according to the invention is easy, since the

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control mechanism of the apparatus is adapted to compute the derivative (I. e. the differential quotient by the time) on the basis of the temperature values which are available anyway, so there is no need for modification of the control mechanism.

5 The advantage of the method according to the invention is that possible damage of the deep fryer apparatus and also burning out of the heating element can be prevented.

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ABSTRACT

Method and control arrangement for terminating an accidental switch on of a deep fryer apparatus when it is not filled with oil, the apparatus comprises a vessel having closed bottom and sides, and a horizontally formed electric heating element for direct contact with the oil within the vessel. At one or more points of the inner space of the vessel the temperature $[(1,2)]$ is measured, by which the accidental switch on state of the apparatus is detected and terminated at the same time in such a way that a derivative $[(3)]$ of the temperature $[(1,2)]$ measured at the one or more determined points is defined. The heating power $[(4)]$ is automatically cut off to terminate switched on state when the value of the derivative $[(3)]$ exceeds a predetermined threshold value.